Scientific Notation

STEM fields are exciting careers in the 21st Century. STEM stands for "Science, Technology, Engineering and Mathematics" related work. Would you like to be a doctor? Or become a computer scientist and design computers and programs? Or a civil engineer and work with architects to build bridges and skyscrapers? Would you like to explore new ideas and tackle ancient unsolved problems as a mathematician? All STEM workers are fluent in Scientific Notation. Scientific notation is a compact way of representing very large, or very small, measurements.

Large measurements include distances between stars & planets, moons and asteroids, galaxies and superclusters. These measurements are represented with **POSITIVE** exponents. A scientist working with astronauts at NASA must be very precise with large measurements, often to 10 or more decimal places in calculations! Telescopes aid in improving these calculations based on human observation.

Addition & Subtraction:

$5.3 * 10^4 + 2.8 * 10^4 =$ $53,000 + 28,000 = 81,000 =$ $8.1 * 10^4$	$6.2 * 10^3 - 5.1 * 10^2 =$ $6,200 - 510 = 5,690 =$ $5.69 * 10^3$

Small measurements, things seen under microscopes, are represented with **NEGATIVE** exponents. Computers are designed smaller and smaller, and parts in your smartphone are measured in "micrometers" $10^{-6}$and "nano-meters" 10^{-9}. Medical instruments, computer parts, factory built machinery of any kind, are made with precise measurements. The permitted error of these parts, so that they all fit together, is called **tolerance.**

Addition & Subtraction:

$2.5 * 10^{-2}m + 7.6 * 10^{-2}m = 1.01 * 10^{-1}m$	$9.5 * 10^{-9}m - 7.1 * 10^{-9}m = 2.4 * 10^{-9}m$

Multiplication and Division Examples:

1. **A grain of sand weighs about $1 * 10^{-6}$grams.**
   Researchers at the University of Hawaii estimate there are $7.5 * 10^{18}$ grains of sand in the world. How much do all the grains of sand in the world weigh? Write your answer in scientific notation.

$$(1 * 10^{-6}) * (7.5 * 10^{18}) = (1 * 7.5) * (10^{-6+18}) = 7.5 * 10^{12}$$

2. **In 2012, the population of China was about $1.351 * 10^9$and the population of Japan was about $1.276 * 10^8$.Based upon these estimates, how many more people lived in China than in Japan in 2012? Write your answer in scientific notation.**

$$(1.351 * 10^9) \div (1.276 * 10^8) = 1.05877 * 10^1 \approx \textit{more than } 10x \textit{ the population.}$$

SHSAT Lesson #6 Classwork: Scientific Notation

1. 1,000,000 can be written as 10^x.What is x?	A. 4 B. 5 C. 6 D. 7 E. 8
2. Which of the following is 340.5 in scientific notation?	A. $3.405 * 10^1$ B. $3.405 * 10^2$ C. $340.5 * 10^3$ D. $3405 * 10^2$ E. $3405 * 10^3$
3. Which of the following is 459.81 * 100 in scientific notation?	A. $4.5981 * 10^2$ B. $4.5981 * 10^3$ C. $4.5981 * 10^4$ D. $4.5981 * 10^5$ E. $4.5981 * 10^6$
4. $(8 * 10^8) \div (4 * 10^6)$ in scientific notation equals	A. $2 * 10^1$ B. $0.2 * 10^3$ C. $2 * 10^2$ D. $2 * 10^1$ E. $20,000 * 10^{-2}$
5. Which of the following is $80,023$ in scientific notation?	A. $0.80023 * 10^2$ B. $8.0023 * 10^2$ C. $8.0023 * 10^3$ D. $80.023 * 10^3$ E. $800.23 * 10^3$
6. Which of the following is $720,500 \div 100$ in scientific notation?	A. $720.5 * 10^2$ B. $7.205 * 10^2$ C. $720.5 * 10^2$ D. $72.05 * 10^3$ E. $7.205 * 10^3$

SHSAT Lesson #6: Classwork (EASY LEVEL)

7. Express 0.02718 in scientific notation	A. $2718 * 10^{-1}$ B. $2.718 * 10^{-2}$ C. $0.2718 * 10^{1}$ D. $0.02718 * 10^{2}$ E. $2.718 * 10^{2}$
8. $5.8 * 10^{4} + 1.1 * 10^{4}$ is equal to	A. $5.9 * 10^{4}$ B. $6.8 * 10^{4}$ C. $6.9 * 10^{4}$ D. $6.9 * 10^{4}$ E. $6.839 * 10^{4}$
9. If N = $\sqrt{100 - 9}$, *then N is*	A. A number between 9 and 10 B. A number between 8 and 9 C. A number between 7 and 8 D. A number between 6 and 7 E. 9
10. $\sqrt{2^{6}} + 1.12345 =$	A. 8.12345 B. 9.12345 C. 17.12345 D. 33.12345 E. 65.12345
11. $3.4 * 10^{2}$ added to $3.4 * 10^{2}$ is equal to	A. $6.8 * 10^{2}$ B. $6.8 * 10^{4}$ C. $3.4 * 10^{4}$ D. $3,400$ E. $3,434$
12. Which of the following is a multiple of 8 ?	A. 1775 B. 1872 C. 1914 D. 2003 E. 2071

SHSAT Lesson #6: Classwork (MID LEVEL)

13. If $(2.54 * 10^{-2}m)(3.81 * 10^{-2}m)$ equals $(a.----) * 10^{-4}m^2$, then what is a ?	A. 6 B. 7 C. 8 D. 9 E. 10
14. If $(0.4)^2$ equals n hundredths, then n =	A. 40 B. 16 C. 8 D. 4 E. None of these
15. $1.224 * 10^2 - 5.98 * 10^1 =$	A. $1224 - 5.98$ B. $122.4 - 598$ C. $122.4 - 5.98$ D. $122.4 - 59.8$ E. $1.224 - 598$
16. $(3.3 * 10^5) * (2.5 * 10^2) =$	A. $8.25 * 10^3$ B. $825 * 10^6$ C. $8.25 * 10^7$ D. $82.5 * 10^7$ E. $8.25 * 10^{10}$
17. Express the product of $(8 * 10^2)$ and $(8 * 10^4)$ in scientific notation.	A. $6.4 * 10^7$ B. $6.4 * 10^6$ C. $6.4 * 10^6$ D. $6.4 * 10^5$ E. $8 * 10^6$
18. Which of the following numbers is closest to the product $48.9 * 21.2$?	A. 10,000 B. 8,000 C. 1,000 D. 100 E. 70

SHSAT Lesson #6: Classwork (CHALLENGE LEVEL)

19. Let n be an integer from -5 to 2 inclusive. What is the range of values of $(n^2 - 1)$?	A. $-25 \leq (n^2 - 1) \leq 4$ B. $0 \leq (n^2 - 1) \leq 25$ C. $-5 \leq (n^2 - 1) \leq 24$ D. $-1 \leq (n^2 - 1) \leq 25$ E. $-1 \leq (n^2 - 1) \leq 24$
20. Express $(2 * 10^2)(2 * 10^4) + (3 * 10^5)$ in scientific notation	A. $7.0 * 10^{11}$ B. $4.03 * 10^6$ C. $4.3 * 10^6$ D. $1.0 * 10^{11}$ E. $4.3 * 10^{11}$
21. Rewrite the sum of $3.94 * 10^2$ and $3.94 * 10^3$ in scientific notation.	A. $0.4334 * 10^6$ B. $4.334 * 10^3$ C. $7.88 * 10^5$ D. $7.88 * 10^3$ E. $4.3 * 10^6$
22. $(0.4)^{-2} \div (0.6)^{-2}$	A. 2.25 B. 4/9 C. -2.25 D. 625/36 E. None of these
23. $(0.6)^{-2} \div (0.4)^{-2}$	A. 2.25 B. 4/9 C. -2.25 D. 625/36 E. None of these
24. Express 0.000582 in scientific notation.	A. $5.82 * 10^{-5}$ B. $5.82 * 10^{-4}$ C. $5.82 * 10^4$ D. $0.582 * 10^5$ E. $5.82 * 10^6$

SHSAT Lesson #6: Classwork: Grid In Questions (ALL LEVELS)

25. **(Easy Level)** $2.54 * 10^{-2} + 2.54 * 10^{-2} = a * 10^{-2}$ What is "a" ?	Grid In
26. **(Easy Level)** $3.1 * 10^{2} - 1.55 * 10^{2} = m * 10^{2}$ What is "m" ?	Grid In
27. **(Mid Level)** What is the sum of the first 5 consecutive two digit prime numbers ? Primes = {2,3,5,7,11,13,17,19…}	Grid In
28. **(Mid Level)** If $x = 9,\ y = (-9)\ and\ z = (-1)$,what is the value of $yz + \sqrt{x} + yz - \sqrt{x}$?	Grid In
29. **(Challenge Level)** If $a = 2.2 * 10^{3}$ and $b = 9.5 * 10^{4}$, what is $10a + b =$	Grid In
30. **(Challenge Level)** Miriam is 11 years older than Charles. In three years, she will be twice as old as Charles will be then, How old was Miriam 2 years ago ?	Grid In

SHSAT Lesson #6 Homework: Scientific Notation

1. Which is equal to: $(1.9 * 10^4) + (1.9 * 10^4)$?	A. $3.8 * 10^4$ B. $3.8 * 10^8$ C. $1.9 * 10^4$ D. $19,000$ E. $190,000$
2. $(2 * 10^6) * (2 * 10^{12})$	A. $(2 * 10^{18})$ B. $(4 * 10^{18})$ C. $(22 * 10^{18})$ D. $(4 * 10^{72})$ E. $(8 * 10^{72})$
3. $(7^5 + 7^4)$	A. (7^4) B. (14^4) C. (7^9) D. $(8)7^4$ E. (14^9)
4. $(9.8 * 10^{12}) \div (2 * 10^7) =$	A. $4.9 * 10^5$ B. $4.54 * 10^5$ C. $4.55 * 10^5$ D. $9.6 * 10^5$ E. $7.8 * 10^5$
5. If N = $\sqrt{36 - (-100)}$, *then N is*	A. A number between 9 and 10 B. A number between 10 and 11 C. A number between 11 and 12 D. A number between 12 and 13 E. 13
6. Four blue oysters weigh $1.0 * 10^2\ grams$, $1.2 * 10^2 g$ $1.4 * 10^2 g$, and $1.1 * 10^2 g$. What is the total weight of the four oysters ?	A. $4.7 * 10^2\ grams$ B. $47 * 10^2\ grams$ C. $4.7 * 10^3\ grams$ D. $4.7 * 10^8\ grams$ E. $5.5 * 10^2\ grams$

SHSAT Lesson #6: Homework (EASY LEVEL)

7. If N = $\sqrt{144 - 81}$, *then N is*	A. A number between 9 and 10 B. A number between 8 and 9 C. A number between 7 and 8 D. A number between 6 and 7 E. Less than 3
8. $1.234 * 10^3 - 3.92 * 10^1 =$	A. $1234 - 3.92$ B. $1234 - 39.2$ C. $123.4 - 2.92$ D. $123.4 - 39.2$ E. $1.234 - 392$
9. $\sqrt{3^6} + 1.12345 =$	A. 29.12345 B. 28.12345 C. 17.12345 D. 13.12345 E. 10.12345
10. Which number is divisible by 4?	A. 1777 B. 1802 C. 1926 D. 1944 E. 2023
11. What does the digit 7 represent in the number 263,471,589 ?	A. 7,000 B. 10,000 C. 70,000 D. 100,000 E. 700,000
12. What is the value of $4^3 - 2 * 2^3$	A. 80 B. 64 C. 60 D. 48 E. 32

SHSAT Lesson #6: Homework (MID LEVEL)

13. Rewrite the sum of $(6.7 * 10^2) + (1.2 * 10^3)$ in scientific notation	A. $0.804 * 10^5$ B. $1.87 * 10^3$ C. $8.04 * 10^5$ D. $7.9 * 10^5$ E. $7.9 * 10^6$
14. Express the positive difference of $(6.7 * 10^2)$ *and* $(1.2 * 10^3)$in scientific notation	A. $6.3 * 10^1$ B. $0.55 * 10^2$ C. $5.3 * 10^{-1}$ D. $5.3 * 10^1$ E. $5.3 * 10^2$
15. Multiply: $(3 * 10^5)(7.15 * 10^2)$ express the answer in scientific notation	A. $21.45 * 10^7$ B. $21.45 * 10^8$ C. $21.45 * 10^9$ D. $2.145 * 10^8$ E. $2.145 * 10^8$
16. Express $(2 * 10^2)(2 * 10^4) + (3.15 * 10^6)$ in scientific notation	A. $7.15 * 10^7$ B. $7.15 * 10^6$ C. $7.115 * 10^6$ D. $7.115 * 10^7$ E. $715 * 10^5$
17. Which of the following is equal to 483 * 0.0793 ?	A. $48.3 * 7.93$ B. $4.83 * 793$ C. $0.0483 * 7930$ D. $48.3 * 79.3$ E. $4.83 * 7.93$
18. What is the value of $8.9 * 10^3$?	A. 0.0089 B. 0.00089 C. 8,900 D. 89,000 E. 890,000

SHSAT Lesson #6: Homework (CHALLENGE LEVEL)

19. $(1.23 * 10^4) + (3.4 * 10^5) = n * 10^5$. In this equation, what is n?	A. 4.63 B. 3.523 C. 1.57 D. 1.24 E. None of the above
20. Express 2200/7 in scientific notation, to two decimal places	A. $3.14 * 10^2$ B. $3.14 * 10^3$ C. $3.14 * 10^4$ D. $3.28 * 10^3$ E. $3.28 * 10^4$
21. Let n be an integer from -7 *to* 3 inclusive. What is the range of values of $(n^2 + 2)$?	A. $0 \leq (n^2 + 2) \leq 49$ B. $0 \leq (n^2 + 2) \leq 51$ C. $-47 \leq (n^2 + 2) \leq 51$ D. $2 \leq (n^2 + 2) \leq 49$ E. $2 \leq (n^2 + 2) \leq 51$
22. The sum of $2^{10} + 1^{10} + (\frac{1}{2})^{10} + (\frac{1}{3})^{10} + (\frac{1}{4})^{10}$ is closest to	A. 21 B. 32 C. 513 D. 1,025 E. 2,000
23. 123*456*789=	A. $4.4253429 * 10^7$ B. $4.4253431 * 10^7$ C. $4.4253432 * 10^7$ D. $4.4253433 * 10^7$ E. $4.4253435 * 10^7$
24. $\frac{6.5*10^8}{3.25*10^3} =$	A. $2 * 10^{11}$ B. $2 * 10^5$ C. $2 * 10^{-5}$ D. $2 * 50$ E. $2 * 10^{8/3}$

SHSAT Lesson #6: Homework: Grid In Questions (ALL LEVELS)

25. **(Easy Level)** 200% of 7 is	Grid In
26. **(Easy Level)** $2.54 * 10^{-2} + 5.08 * 10^{-2} = a * 10^{-2}$ What is "a" ?	Grid In
27. **(Mid Level)** If a dozen bananas costs \$5 and a dozen pears cost \$8 then how much is it for 1.5 dozen pears and 2.5 dozen bananas ?	Grid In
28. **(Mid Level)** How many squares, with sides length of a positive whole number, are less than 200 square units in area ?	Grid In
29. **(Challenge Level)** The value of $9\sqrt{15} - 4\sqrt{15}$ as rounded to the nearest integer value is	Grid In
30. **(Challenge Level)** Ann can solve 48 problems in 21 minutes, and Sara can solve 36 problems in 84 minutes. How many problems can Ann solve in the same amount of time it takes Sara to solve 54 problems?	Grid In